

# Meteorological Measurement System (MMS)

**Instrument:** ER-2 Meteorological Measurement System (MMS) for SOLVE

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**Measurement Description:** The MMS consists of three major systems: an air-motion sensing system to measure air velocity with respect to the aircraft, an aircraft-motion sensing system to measure the aircraft velocity with respect to the earth, and a data acquisition system to sample, process, and record the measured quantities. The three-dimensional wind vector is derived by differencing the air velocity from the aircraft velocity.

The air-motion system consists of differential pressure taps, two total temperature probes with different response times, a pitot-static pressure probe, and a dedicated static pressure system. All probes and sensors are judiciously located at specific positions on the fuselage for optimum aerodynamic performance. The aircraft-motion sensing system consists of an embedded GPS ring laser inertial navigation system (Litton LN-100G), mounted on the aircraft body axis in the upper Q- bay. The data system is also located in the upper Q-bay.

The MMS calibration processes determine (1) the static accuracy of individual sensors, (2) the dynamic response of systems and sensors, (3) the accuracy and dynamic characteristics of the inertial navigation system, and (4) parameter calibration constants, which eliminates aircraft maneuver signatures from the measured atmospheric data. Data quality is finally assessed using spectral analysis and consistency with fluid dynamical laws. The accuracy summarized below is achieved after a thorough and proper system calibration.

**Primary products:** (1 Hz & 5 Hz)

	Typical value at ER-2 Altitude		Precision	Accuracy
Pressure	60 mb	0.1 mb	$\pm 0.3$ mb	0.5%
Temperature	180 K	0.1 K	$\pm 0.3$ K	0.2%
Horizontal Wind	30 m/s	0.1 m/s	$\pm 1$ m s <sup>-1</sup>	3.3%
Vertical Wind	<1 m/s	0.1 m/s	time averaged = 0.0 m/s	

**Secondary Products:** (1 Hz & 5 Hz) Calculated: potential temperature, true-air-speed, turbulence (0.8 - 1.5 Hz)

Measured: positions, velocities, accelerations, pitch, roll, heading, angle of attack, angle of sideslip, static and total pressures, total temperatures

**Proposed Modifications for SOLVE:** We plan to implement the following: (1) integrate a dedicated MMS pitot/static system, independent from the aircraft avionics; (2) improve pressure measurement with temperature correction; (3) provide differential GPS position data when available from the LandStar Global Coverage; and (4) upgrade the data acquisition system

## References:

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